TOSHIBA

6F9G0133

INSTRUCTION MANUAL

HIGH－VOLTAGE

VACUUM CONTACTORS

MOTOR&TRANSFORMER APPLICATION

TYPE:CV-10HA 12/15kV－400A－5/4kA

TYPE:CV-10HAL 12/15kV－400A－5/4kA

May, 2001

REV. 4

TOSHIBA CORPORATION
SOCIAL INFRASTRUCTURE SYSTEM COMPANY

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Read this manual carefully to fully understand the operation.
And keep for maintenance.

WARNING : Never remodel or disassemble the equipment nor mount nonstandard components.

This equipment shall only be used inside a metal enclosure (grounded) in other establishments than domestic , or those that are connected to the public power source system.

1. GENERAL DESCRIPTION

(1) Ambient condition

The type CV vacuum contactor is manufactured in accordance with IEC 60470(2000).
The vacuum contactor should be used in the following conditions.

Table 1
Normal service condition

−Altitude	:	Less than 1000m
−Ambient temperature	:	−5℃ min. to +40℃ max. Its average over a period of 24h does not exceed +35℃
−Relative humidity	:	45% min. to 85% max.
−Vibbration	:	20Hz −9.8m/s^2 or less

CAUTION : Do not use in condition other than those specified above , please consult .

(2) Locative condition

The location where the contactor is to be installed should be free from dust.
Corrosive gas and moisture.
When it is be used in a chemical plant or in outdoor panels,
take necessary precautions against corrosion,
water seepage and condensation.
See page 2.

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2. PRECAUTIONS IN SPECIAL APPLICATION (outdoor cubicle etc.)

In application, check the follow items, please carry out the maintenance frequently. or perform the countermeasure.
(Visual inspection: once a month, regular inspection: once a year)

Table 2 Precaution in special application

Special condition	Instance	Caution items
Contamination Sea breeze	Dust, iron-dust etc. is very more place. Place where suffer the sea breeze.	Reduction of ventilation Setting of ventilation for sea breeze. Frequent inspection.
High humidity	Place where very more snow and ice. More humidity. Place where near the cooling tower. Place where cause changing the temperature suddenly.	Setting the space heater. Setting the ventilation. Prevention of flooding into the cable pit.
Corrosion gas	Corrosion gas which come into the airport, chemical Industry and water cleaning. (EX.) SO_2 , Cl_2 ,NO_2	Protection from corrosion gas . Anti-gas treatment. Examination of changing of the insulation material.

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3. RECEIVING AND UNPACKING

WARNING : If any parts are damaged or missing. Do not install that has been damaged.

Make the following checks after unpacking :

(1) Check if there is any damage , foreign matter trapped , or water seepage into the contactor.

(2) Check the nameplate to see if the specifications on the plate are correct.

(3) Check the contact wear gauge and control cable.

(4) Check the tripping rod (Latched type).

4. STORAGE AND HANDLING

When the contactor is to be stored over a long period , the storage area should be dry and dust free area.
If the contactor is left outdoors or in adverse conditions , corrosion from gas , rust or insulation deterioration may result.

CAUTION : In handling , do not throw or drop contactor.
The contactor may break.

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5. INSTALLATION

When installing , protect from dust. Particularly when the contactor is installed while the building is under construction , shield it from cement dust and other foreign matter.

The following precautions should be taken.

(1) The mounting surface must be horizontal (level : less than ±1mm).
When the mounting surface is not horizontal , adjust with spacers.

(2) There are four mounting holes.
Use M10 bolts to securely mount the contactor.

(3) In wiring the main circuit terminals , ground terminals and control circuit , wires should be given sufficient length to be flexible.
The ground wires should be more than 5.5mm^2 in cross section.

(4) Do not mount the contactor with its front inclined downward.
This may result in malfunction.

(5) Do not touch the vacuum interrupter surface with soiled hands.

(6) When it is applied to a capacitor load , be sure to used a space heater to keep humidity low.

CAUTION : Do not install on energize contactor that has been bad condition.

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6. RATING

DANGER : Do not exceed the ratings specified on the contactor.

Table 3 Ratings

Type− form		CV−10HA	CV−10HAL
Operating mechanism		Non-latched	Latched
Rated operation voltage (kV)		12/15	
Rated insulation level (kV)		AC.28 , Imp.75	
Rated operational current (A)		400	
Thermal current (A)		450	
Rated frequency (Hz)		50/60	
Rated short-time withstand current (A-s)		5000−1	
Rated peak withstand current (A)		12500	
Rated duties	Operations/hour	300	120
	On load factor	40%	
Rated making capacity (kA)		4(C−10s×100times)	
Rated breaking capacity (kA)		3.2(CO−30s×25times)	
Short-circuit making and breaking current (kA)		5/4	
	Duties	O−3min−CO−3min−CO	
Withstand overload current (kA-s)		8.0−1sec , 2.4−30sec	
Mechanical operation (million)		0.25	
Electrical operation (million)		0.1	
Rated supply voltage (Standard)	Closing voltage	100−240VAC 100−220VDC	100−240VAC 100−250VDC
	Tripping voltage	−	100−110VDC
Auxiliary switches	Contact arrangement	4NO−2NC	2NO−1NC
	Life (million)	0.1	
Operating current (A) (at 100V)	Closing	6∼7	
	Holding/Tripping	0.6∼0.7	3∼4

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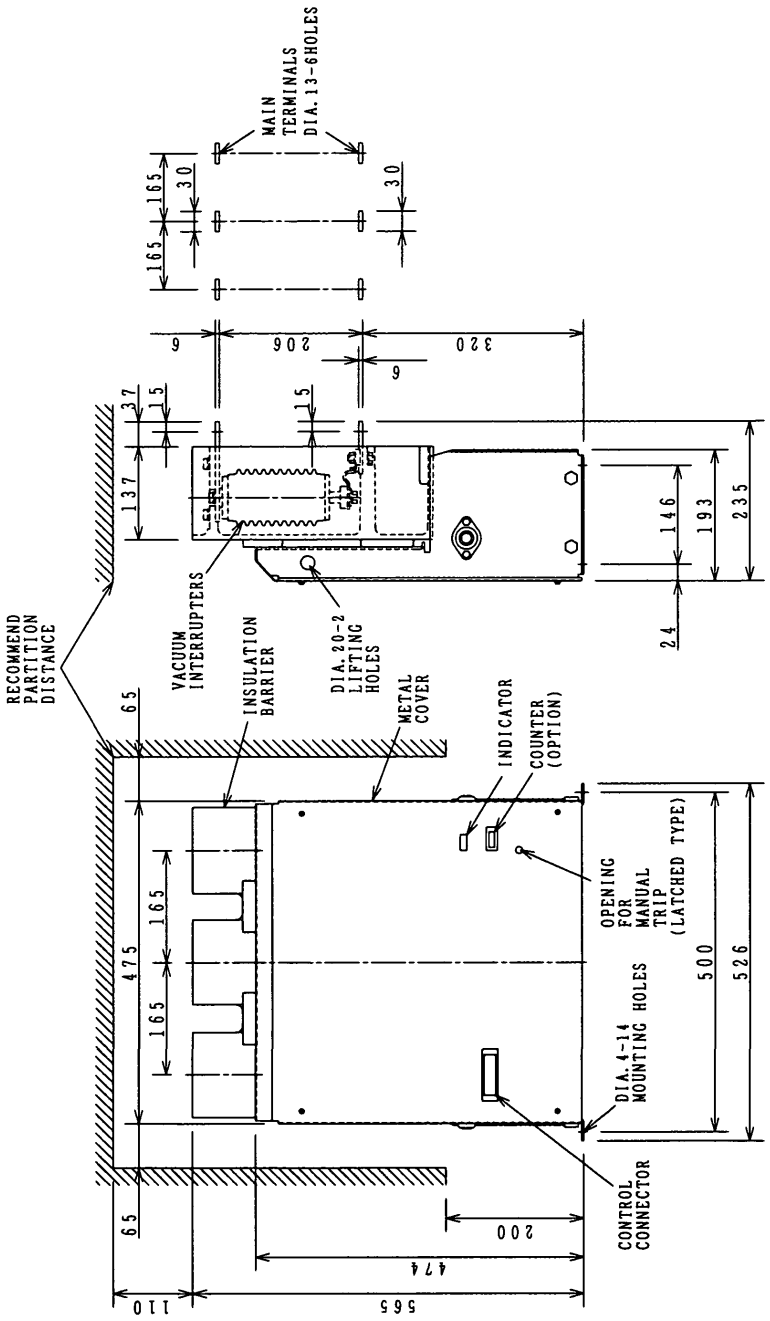
7 . OUTLINE DRAWING



TYPE CV-10HA(L)
(HORIZONTAL MAIN TERMINALS)

Fig.1 OUTLINE DRAWING(mm)

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8. STRUCTURE

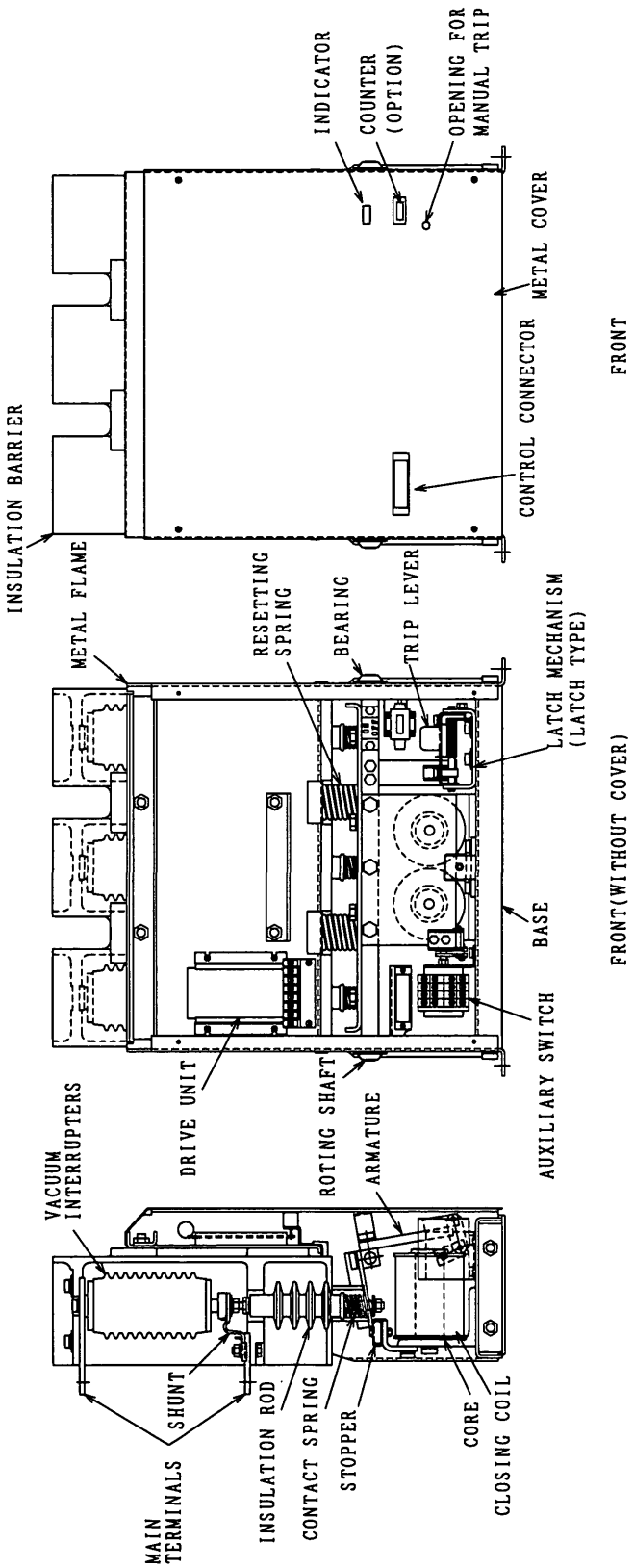

Fig. 2 STRUCTURE OF CV-10

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9. OPERATION

The drive unit for the electromagnet is installed in the bottom frame.
Molded and wired on the printed circuit.
The closing circuit can be operated using either in AC or DC by the drive unit.
The optional latch trip circuit uses DC as standard.
When a latched contactor is operated using AC power, it is recommended that a Capacitor trip device be used.

The standard operating voltage is as follows:

Non-latched type(normally energized) : 100－240 V AC /100－220V DC
Latched type :100－240V AC /100－250V DC closing voltage
:100－110V DC tripping voltage

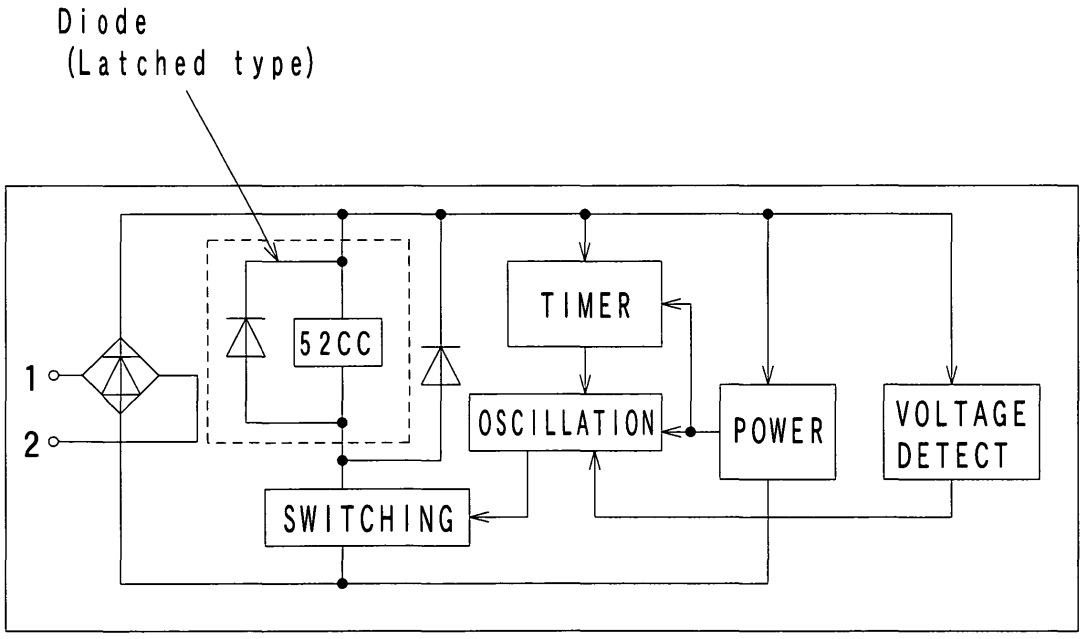

Fig.3 Internal Configuration of Drive Unit

CAUTION : Do not touch the drive unit without trouble.

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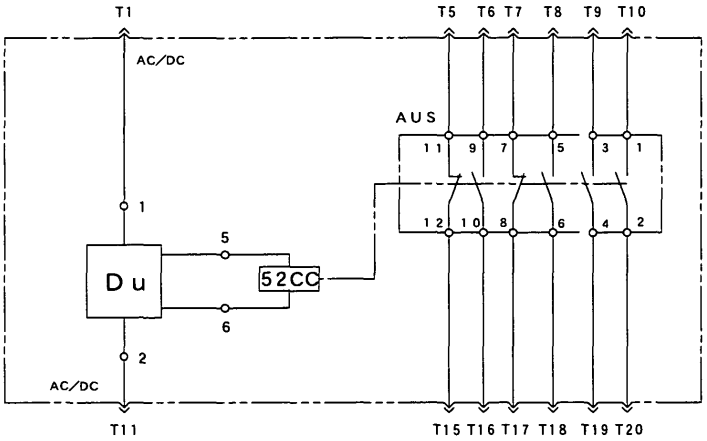
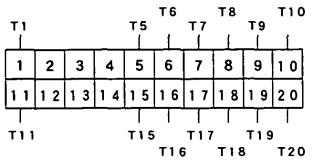
(1) CONNECTION OF CONTROL POWER SUPPLY

Fig.4 and Fig.5 show the internal connections of the normally energized type latched type respectively.
According to there figures, connection should be made of the control power supply and open / close command contact (power relay contact).

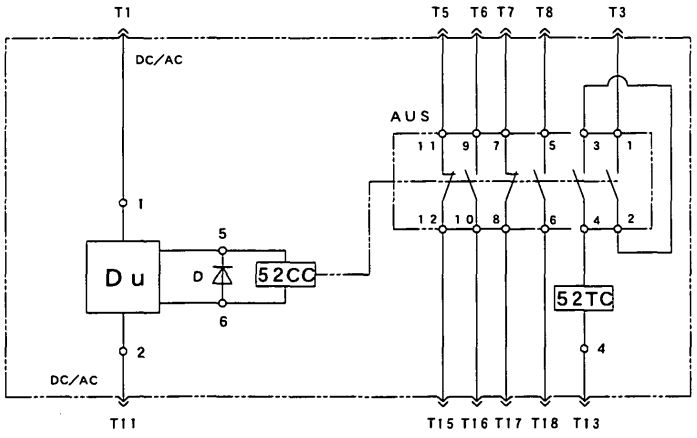


記 号	名 称
52CC	CLOSING COIL OF CONTACTOR
Du	DRIVE UNIT
AUS	AUXILIARY SWITCH
1～6	CONTACTOR TERMINAL NUMBERS

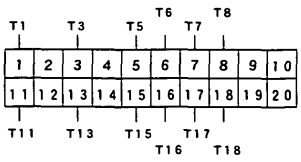


CONTROL CONNECTOR

Fig.4 Internal connection of the normally energized type.



記 号	名 称
52CC	CLOSING COIL OF CONTACTOR
Du	DRIVE UNIT
AUS	AUXILIARY SWITCH
1～6	CONTACTOR TERMINAL NUMBERS
52TC	TRIPPING COIL OF CONTACTOR
D	DIODE



CONTROL CONNECTOR

Fig.5 Internal connection of latched type.

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(2) STANDARD OPERATION CIRCUIT

Shown below are the vacuum contactor and its auxiliary circuits (control and monitoring).
Fig.6 represents the standard operation circuit of the normally energized type and Fig.7 the latched type.
Wiring should be done according to these circuit diagrams.

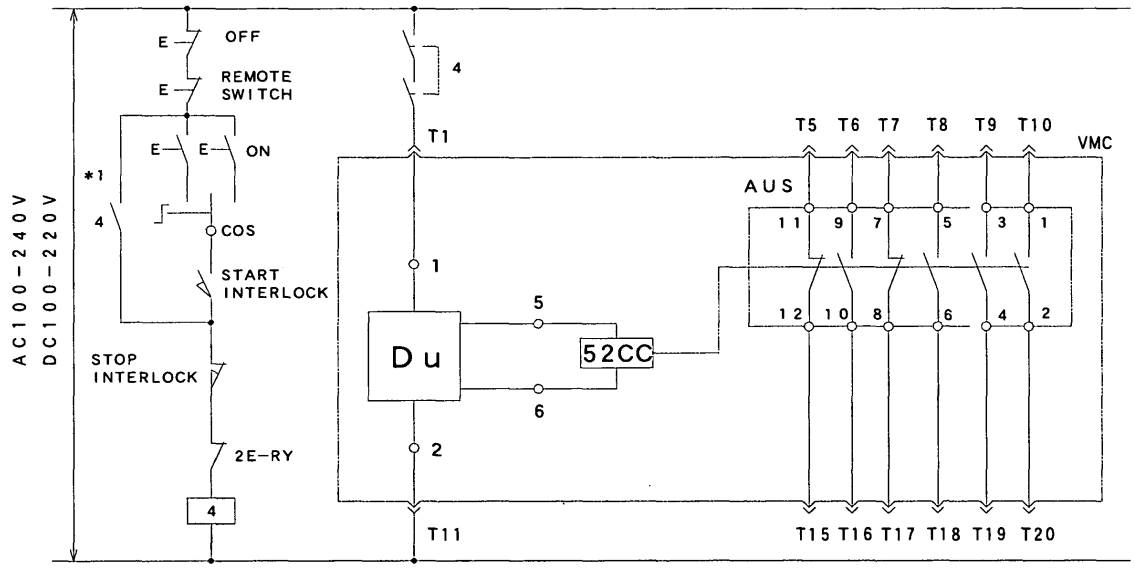

Fig.6 Standard operation circuit of normally energized type.

NOTE:● Be sure to use quickly AC auxiliary relay contact NO for self−holding. If the self−holding circuit is formed by using the auxiliary contact No of the vacuum contactor , welding of the main contact may result when the start button is pushed incompletely(refer to *1 in Fig.6).

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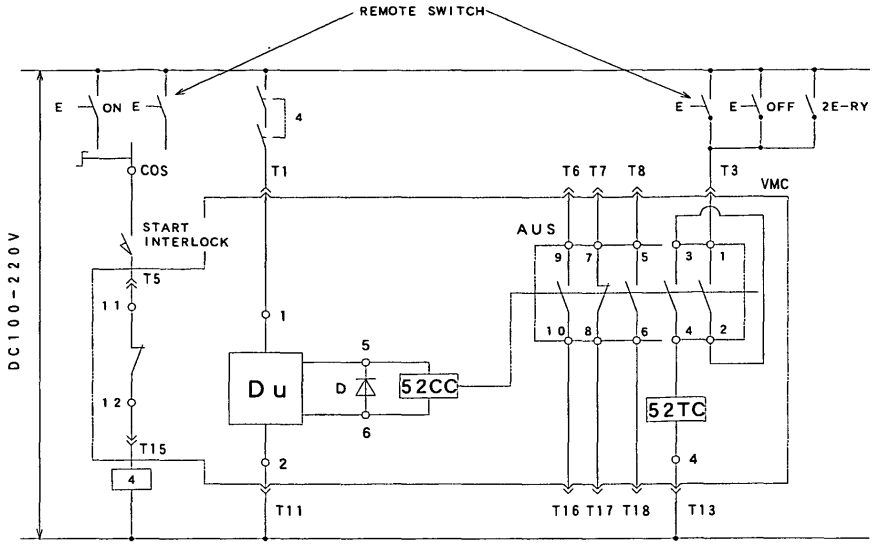
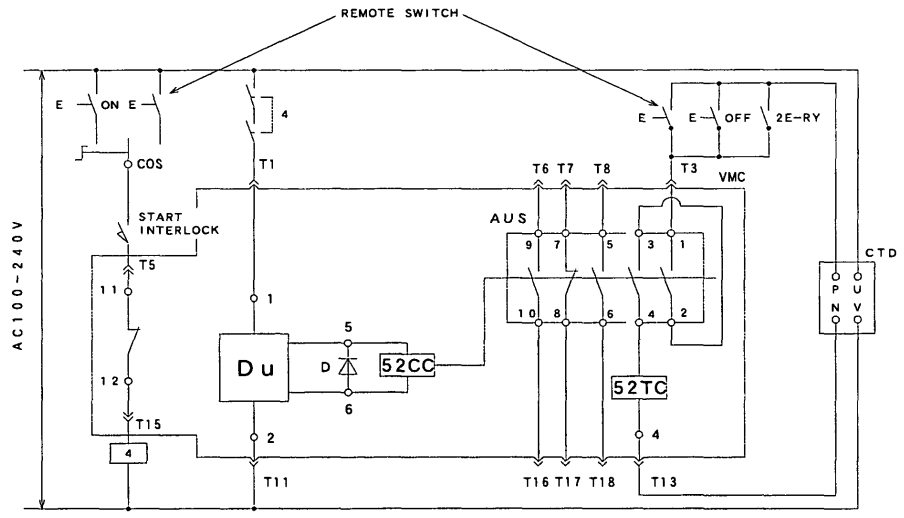


(a) Shunt trip



(b) Capacitor trip

Fig.7 Standard operation circuit of latched type.

NOTE : ● Electrical trip−free circuit must be prepared outside the contactor.

● A stable DC power source such as battery is recommended for the control circuit.
If DC power source is not available, employ a AC closing and a Capacitor trip.

● Be sure to use the control connector between No.3 and No.13 (auxiliary contact) for trip circuit.
Connect the control connector between No.5 and No.15 (auxiliary contact) for control relay circuit.

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10. Trial operation

Warning : Make sure main power is OFF.

After mounting and wiring of the vacuum contactor, make the following inspections.

1) Check for any loose connections.
2) Check for any wiring errors. Perform this test with only the control circuit energized. confirm that the operation is correct. For the latched type contactor, check that the latch correctly engages and trips when the close/trip signals are applied. Also, manually trip the contactor using trip lever to verify proper operation.

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11. INSPECTION AND MAINTENANCE

To maintain the function and performance of the vacuum contactor for a long period of time, the following inspections and maintenance procedures are recommended.

The intervals between inspections may vary depending on the conditions of use and the environment under which the contactor is used. The initial inspection should be carried out within one year of the start of equipment operation, and the succeeding check intervals should be determined according to the result of the initial inspection. See Section 2 for use under special environment as in outdoor cubicles.

(1) Patrol Inspection(every 1－6 months)

With the cubicle energized, visually check from out side the cubicle according to the check list of Table 4,5.

WARNING : When opening the door of the cubicle, do not come close to danger area.

Table 4 Patrol inspection items

Check item	What to check
Abnormal noise	Check if corona discharges or operation magnets are not producing noise.
Abnormal smell	Check if corona discharges or overheat are not producing abnormal smell.

Table 5 Patrol inspection items(cont.)

Check item	What to check
Abnormal discoloration	Is there not any discoloration due to overheat?
Damage	Is there not any crack, break or dislocation of insulating material or operation tools?
Open/close indication	Is the OPEN/CLOSE indication (lamp) normal?

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(2) Periodical Inspection/Detailed Inspection(every 1－2 years or every 20,000 operations)

The facility should be removed out of service and perform inspection According to the instruction given in Table 6.

WARNING : Contact with energized components can cause severe injury or death. Turn-off and lock out primary and control circuit before servicing.

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Table 6 Periodical inspection and detailed inspection

Location		What to inspect	Decision criteria	What to do
Contactor as a whole	Appearance	Abnormal appearance damage	Check by sight.	Replace broken Parts.
	Insulating Material	Check if moisture or dust adheres to the insulator. Under dusty environments, frequent inspection should be done.	Check by sight.	Clean.
Operating devices	Sliding parts	Check for wear, loose or seized parts.	Check bye sight. If necessary, check correct operation. Also check loose fastenings.	Clean parts and remove foreign matters. Pour oil in Adequate amount.
	Spring	Rust, deformation, discoloration, or damage.		
	Electromagnets	Discoloration, rust, wear, or loose mounting.		
	Latch mechanism	Check for scores and wear		
	Closing coil, trip coil	Check for discoloration and burned parts.		
	Fastenings	Check for loose bolts or nuts.		
Primary circuit	Terminal, movable conductor	Discoloration of terminal and coupling conductor, loose fastenings.	Check by sight. check the tightness.	Retighten. If necessary, investigate the cause and replace parts.
Interrupter	Vacuum Contact wear	Check contact wear and wipe.	See Table 7.	Replace vacuum Interrupter.
	Vacuum container	Check moisture and dust adhering to the surface.	Check by sight.	Clean.
	Vacuum level	Check vacuum level by withstand voltage test.	Apply AC17kV for 1minutes.	If found abnormal, inform the maker.

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Location		What to inspect	Decision criteria	What to do
Control equipment	wiring	Check for discoloration and tightness.	—	Retighten.
	Auxiliary switch	Amount of dust attached.	Check by sight.	Replace if damage is excessive.
	Drive unit	Overheat, discoloration.	Check by sight.	Replace if abnormal
Insulation resistance	Main circuit	Measure insulation resistance between phases, between electrodes and between circuits and ground. (Measurement is taken by 1000V megger.)	More than 50MΩ	When the insulation resistance is below the standard level, investigate the cause and, if necessary, replace parts.
	Operation circuit	Measure insulation resistance between circuits and ground. (Measurement is taken by 500V megger.)	More than 1MΩ	
Dielectric strength	Main circuit	Measure dielectric strength between phases, between electrodes and between circuits and ground.	AC 1.5E for 10 minutes.	If found abnormal inform the maker.
Open/close operation		Perform open/close operation by electric operation test to confirm the correct operation.		If found abnormal, check and repair. If necessary, replace faulty parts.

Remarks: For extraordinary (unscheduled) inspections , pick up check items from the above table.

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Table 7 Gap/wipe standard value

(mm)

Parts name		Gap	Wipe	Allowable wear
Vacuum interrupter	Normally energized type	7.0～7.5	More than 3.0	2.0
	Latch type	7.0～7.5	More than 2.8	1.8

12. CRITERIA FOR DURABILITY

(1) Electrical service life

The electrical service life of the vacuum interrupter is defined by the electrode wear the number of open/close operations (mechanical life).

To determine the electrode wear, measure the gap between the lever and washer (dimension A) in a closed start , as shown in Figure8. With the vacuum interrupter closed, if a contact wear gauge or a 1.0mm thickness gauge cannot be inserted , this means the end of life is reached.

For the components listed below, replacement or detailed inspection and cleaning are recommended after the indicated number of operations.

Table 8 Electrical service life

Parts . name	Electrical service life
Vacuum interrupter	100,000 operations or 15 years
Auxiliary switch	100,000 operations or 10 years
Drive unit	100,000 operations or 10 years
Movable conductor	100,000 operations or 15 years

Hence, parts should be replaced around electrical service life operations.

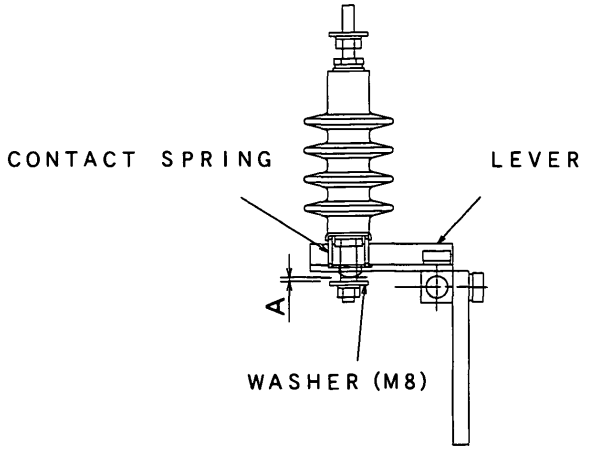

Fig.8 Parts to be inspected

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(2) Mechanical service life

The normally energized type has the mechanical service life of 0.25 million operations , and the latch type 0.25 million operations. (The mechanical service life of the vacuum interrupter is 100,000 operations.)

For the components listed below , replacement or detailed inspection and cleaning are recommended after the indicated number of operations.

Table 9 Recommended replacement parts

Parts name	No. of operation for replacement
Vacuum interrupter	100,000 operations or 15 years
Auxiliary switch	100,000 operations or 10 years
Movable conductor	100,000 operations or 15 years
Latch mechanism	250,000 operations or 10 years
Closing/trip coil	250,000 operations
Movable core	Detailed inspection and cleaning every 100,000 operations.
Stationary core	Detailed inspection and cleaning every 100,000 operations.

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